Remarks/Arguments

Applicant respectfully requests favorable reconsideration of the subject application, particularly in view of the above amendment and the following remarks. Applicant respectfully urges that there is no additional fee for this amendment as the number of independent claims and the total number of claims in the application remain unchanged. Claims 1-14 are currently pending in the subject application.

Applicant has amended the paragraph beginning at Page 5, line 20 of the specification to provide that the anode catalyst layer of the invention claimed by Applicant comprises a binder material comprising lignin. Applicant respectfully urges that this amendment is fully supported by the application as originally filed in that two embodiments of the invention comprising lignin are described in the specification of the application as originally filed. Accordingly, Applicant respectfully urges that this amendment incorporates no new subject matter into the application.

Claim 1 has been objected to on the basis of informalities cited by the Examiner. In particular, the Examiner has required that Applicant change "and" to "or" in the second to last line of Claim 1. Applicant respectfully traverses this requirement on the basis that the proposed language would unduly narrow the scope of the claim to the proton conductive material or the electron conductive material comprising lignin and excluding the embodiment in which both the proton conductive

material and the electron conductive material comprise lignin. See *Brown v. Air Products and Chemicals, Inc.*, 229 F.3d 1120, 56 U.S.P.Q.2d (BNA) 1456 (Fed. Cir. 2001) in which it was found that the language "at least one of two-digit, three-digit, or four-digit representations" in a recitation relating to the setting of year data in a computer clock excluded an apparatus able to perform all three alternatives. The language employed by Applicant is intended to include an anode catalyst layer comprising a proton conductive layer comprising lignin, an anode catalyst layer comprising an electron conductive layer comprising lignin, and an anode catalyst layer comprising a proton conductive layer comprising lignin *and* an electron conductive layer comprising lignin. Changing the language of Claim 1 as required by the Examiner would exclude the third embodiment from the scope of the claimed invention, which is contrary to the intent of Applicant, and which embodiment is fully supported by the description and remaining claims of the application as originally filed. Accordingly, Applicant respectfully urges that the existing language correctly represents the scope of the invention as intended by Applicant; and, thus, Applicant respectfully requests withdrawal of the objection to Claim 1.

Claim 1 has been rejected under 35 U.S.C. 112, first paragraph, because the specification is alleged by the Examiner not to be reasonably enabling for "proton conductive material and said electron conductive material comprising lignin". More

particularly, the Examiner has indicated that although the specification teaches a proton conductive material and/or an electron conductive material comprising a ligno-sulfonic acid and/or an electron conductive polyaniline grafted to lignin, there is no generic teaching that the lignin can be for any proton conductive material or any electron conductive material. In response to this rejection, Applicant has amended the specification, consistent with the language of Claim 1, to include a generic teaching that the proton conductive material and/or the electron conductive material of the anode catalyst layer of the invention claimed by Applicant may comprise lignin. Accordingly, Applicant respectfully urges that this amendment overcomes this rejection.

Claims 1-14 have been rejected under 35 U.S.C. 112, second paragraph as failing to define the invention in the required manner. Specifically, the Examiner indicates that the claim(s) are narrative in form and replete with indefinite and functional or operational language. The Examiner further indicates that the structure which goes to make up the device must be clearly and positively specified; the structure must be organized and correlated in such a manner as to present a complete operative device; and the claim(s) must be in one sentence form only. Applicant respectfully traverses this rejection. Applicant notes that no example of indefinite and functional or operational language has been cited by the Examiner; no example of

missing structure has been cited by the Examiner; and no claim which is not in one sentence form has been cited by the Examiner. Applicant has carefully reviewed the rejected claims for examples of the problems stated by the Examiner, but has been unable to find any such examples. Accordingly, Applicant respectfully requests that this rejection be withdrawn.

The invention claimed by Applicant is a fuel cell comprising an anode electrode, a cathode electrode and a proton exchange membrane electrolyte disposed there between. An anode catalyst layer is disposed on the electrolyte facing surface of the anode electrode or the anode electrode facing surface of the electrolyte. The said anode catalyst layer comprises a proton conductive material and an electron conductive material substantially uniformly dispersed throughout the catalyst layer. The proton conductive material and/or the electron conductive material comprise lignin. In accordance with one embodiment of this invention, the lignin may be in the form of ligno-sulfonic acid. In accordance with an alternative embodiment of this invention, the lignin is part of a grafted polymer, e.g. polyaniline grafted to lignin. Applicant respectfully urges that the prior art relied upon by the Examiner for rejection of the subject application neither teaches nor suggests an anode catalyst layer comprising a proton conductive material and an electron conductive material substantially uniformly dispersed throughout the catalyst layer where the proton

conductive material and/or the electron conductive material comprises lignin as claimed by Applicant.

Claims 1-14 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Srinivas, U.S. Patent Publication No. 2004/0110051 A1 (hereinafter "the Srinivas publication") in view of Tripathy et al., U.S. Patent Publication No. 2002/0183470 (hereinafter "the Tripathy et al. publication"). This rejection is respectfully traversed. The Srinivas publication teaches a composition comprising particulate carbonaceous material and a sulfonated conducting polymer containing hetero atoms. Devices comprising the composition, which may include a metal, include supported electrocatalysts, membrane electrode assemblies and fuel cells. However, the Srinivas publication neither teaches nor suggests an anode catalyst comprising lignin as claimed by Applicant, a fact acknowledged by the Examiner. Rather, the Examiner relies upon the Tripathy et al. publication as teaching an anode catalyst comprising lignin as claimed by Applicant.

The Tripathy et al. patent teaches a method for polymerization of aromatic monomers using derivatives of hematin including assembled hematin. In one embodiment, the polymerization is carried out in the presence of a template, along which aromatic monomers align. Assembled hematin includes alternating layers of hematin and a polyelectrolyte, which are deposited on an electrically charged substrate

(Abstract). The Tripathy et al. publication also teaches the use of electrically conductive polymers in a variety of electronic devices including electro-chromic devices, light-emitting diodes, electrostatic discharge protection, and light weight batteries (Paragraph [0003]). In addition, the Tripathy et al. publication also teaches a method for producing lignosulfonate-Pani complex using hematin (Paragraph [0069]). Although the Tripathy et al. patent generally references the use of electrically conductive polymers including polyaniline in light weight batteries, nowhere does the Tripathy et al. publication specifically teach the use of a lignosulfonate-Pani complex in light weight batteries, nor does the Tripathy et al. publication teach or suggest the use of a lignosulfonate-Pani complex as part of an anode catalyst layer which is both proton and electron conductive employed in a fuel cell as claimed by Applicant. Applicant further respectfully urges that the Tripathy et al. publication does not teach or suggest the use of a lignosulfonate-Pani complex as a component of a proton conductive material in accordance with certain embodiments of the invention claimed by Applicant. Thus, Applicant respectfully urges that it is mere conjecture on the part of the Examiner as to the suitability of a lignosulfonate-Pani complex for use in the anode catalyst layer of a fuel cell as claimed by Applicant.

The Examiner further asserts that, because batteries and PEM fuel cells are electrochemical devices having anodes, cathodes and proton exchange membrane electrolytes, batteries and PEM fuel cells are functionally equivalent. Based upon this assertion, the Examiner argues that substitution of a known equivalent structure involves only ordinary skill in the art. Applicant respectfully urges that fuel cells and batteries are not functional equivalents as asserted by the Examiner. Although they are both electrochemical devices, they operate in substantially different ways. In particular, *a battery has a limited charge requiring either that it be replaced when it is fully discharged or that it be recharged.* That is, a battery will only generate a current until it is discharged. By comparison, *a fuel cell is a continuously operating device which will generate electricity so long as fuel is provided to the cell.* In a battery, *the electrodes are ultimately consumed.* In a normally operating fuel cell, *the electrodes are stable.* Thus, the electrochemical environment of a battery *is substantially different* from the electrochemical environment of a fuel cell. As a result, to the extent that batteries may use catalytic electrodes, longevity of the catalyst is not an issue because it will ultimately be consumed along with the electrodes. In contrast thereto, the longevity of a catalyst in a continuously operating fuel cell in which the electrodes are stable is a critical issue. Given this difference in functionality between a battery and a fuel cell, Applicant respectfully urges that

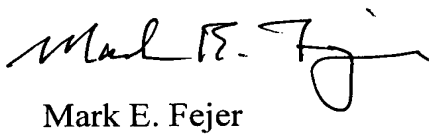
teachings relating to materials suitable for use in battery electrodes are not readily transferable to fuel cells in which the electrodes are stable, requiring stability and longevity of the catalyst materials employed therein. Applicant further respectively urges that, if batteries and fuel cells are functional equivalents as suggested by the Examiner, they should be able to be used interchangeably. While it is true that fuel cells may be used as substitutes for batteries, it is clearly not the case that batteries can be substituted for fuel cells. For example, fuel cells, due to their capability of continuous operation, may be employed for residential, commercial and industrial power generation, whereas batteries are not suitable for such applications due to the fact that they discharge, resulting in the interruption of power generation. It follows that the problems solved by the invention claimed by Applicant including reducing fuel crossover from the anode to the cathode in a fuel cell and catalytic longevity are not issues needing to be addressed in batteries. Accordingly, Applicant respectfully urges that, due to the functional differences between batteries and fuel cells, one skilled in the art would not be motivated to apply teachings relating to the electrodes of batteries to the electrodes of fuel cells. Accordingly, Applicant respectfully urges that the Srinivas publication and the Tripathy et al. publication, alone or in combination, do not render Applicant's claimed invention obvious in the manner required by 35 U.S.C. 103(a).

Conclusion

Applicant intends to be fully responsive to the outstanding Office Action. If the Examiner detects any issue which the Examiner believes Applicant has not addressed in this response, Applicant urges the Examiner to contact the undersigned.

Applicant sincerely believes that this patent application is now in condition for allowance and, thus, respectfully requests early allowance.

Respectfully submitted,



Mark E. Fejer
Regis. No. 34,817

Gas Technology Institute
1700 South Mount Prospect Road
Des Plaines, Illinois 60018
TEL (847) 768-0832; FAX (847) 768-0802